DRAFT Ecological risk assessment conceptual site model for the Portland Harbor Superfund Site
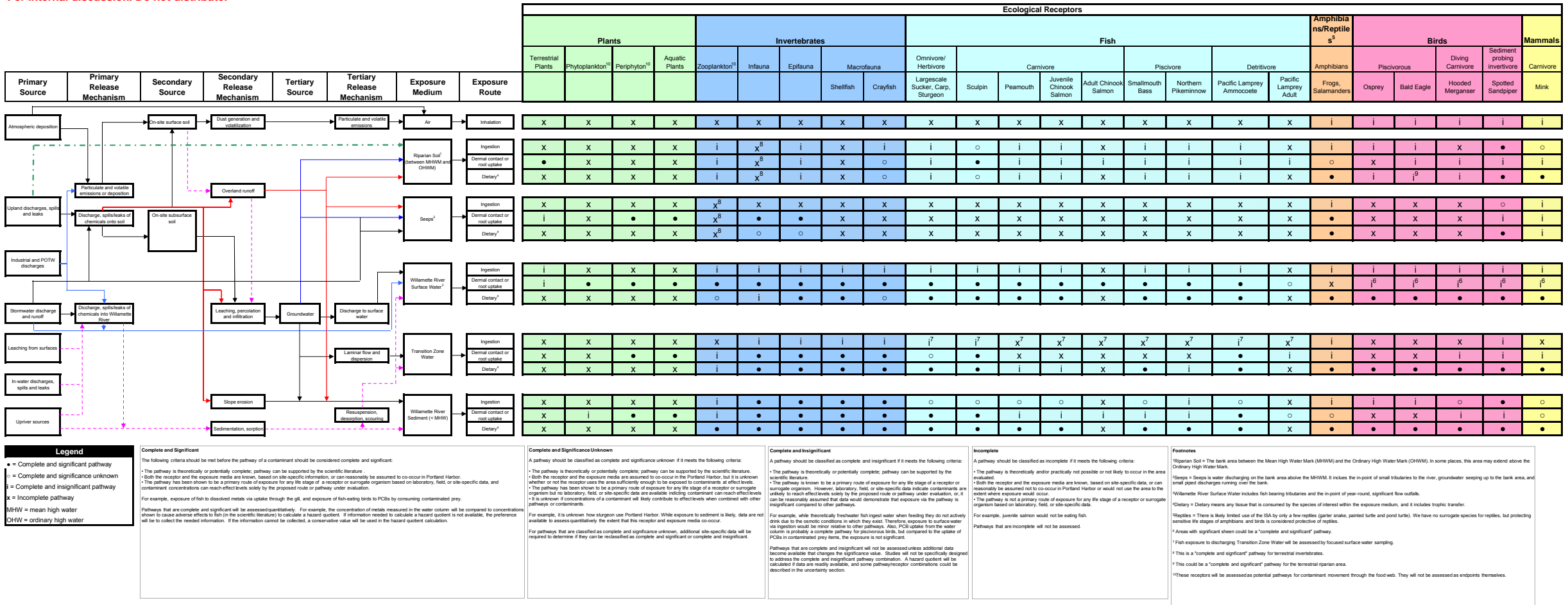## For internal discussion. Do not distribute.

Ecological Receptors

Exposure Medium	Exposure Route	Terrestrial Plants	Phytoplankton[10]	Periphyton[10]	Aquatic Plants	Zooplankton[10]	Infauna	Epifauna	Shellfish	Crayfish	Largescale Sucker, Carp, Sturgeon	Sculpin	Peamouth	Juvenile Chinook Salmon	Adult Chinook Salmon	Smallmouth Bass	Northern Pikeminnow	Pacific Lamprey Ammocoete	Pacific Lamprey Adult	Frogs, Salamanders	Osprey	Bald Eagle	Hooded Merganser	Spotted Sandpiper	Mink
Air	Inhalation	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	i	i	i	i	i	i
Riparian Soil (between MHW and OHWM)	Ingestion	X	X	X	X	i	x[8]	i	X	i	i	○	i	i	X	i	i	i	X	i	i	i	X	●	○
	Dermal contact or root uptake	●	X	X	X	i	x[8]	i	X	○	i	●	i	i	i	i	i	i	i	○	X	i	i	i	i
	Dietary[4]	X	X	X	X	i	x[8]	i	X	○	i	○	i	i	X	i	i	i	X	●	i	i[9]	i	●	●
Seeps	Ingestion	X	X	X	X	x[8]	X	X	X	X	X	X	X	X	X	X	X	X	X	i	X	X	X	○	i
	Dermal contact or root uptake	i	X	●	●	x[8]	●	●	X	X	X	X	X	X	X	X	X	X	X	●	X	X	X	i	i
	Dietary[4]	X	X	●	●	x[8]	○	○	X	X	X	X	X	X	X	X	X	X	X	●	X	X	X	●	●
Willamette River Surface Water[3]	Ingestion	i	X	X	X	i	i	i	i	i	i	i	i	i	X	i	i	i	X	i	X	X	X	X	i
	Dermal contact or root uptake	i	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	○	X	i[6]	i[6]	i[6]	i[6]	i[6]
	Dietary[4]	X	X	X	X	○	i	●	●	○	●	●	●	●	●	●	●	●	X	●	●	●	●	●	●
Transition Zone Water	Ingestion	X	X	X	X	X	i	i	i	i	i[7]	i[7]	x[7]	x[7]	x[7]	x[7]	x[7]	i[7]	x[7]	i	X	X	X	i	X
	Dermal contact or root uptake	X	X	X	X	i	●	●	●	●	○	●	X	X	X	X	X	●	i	i	X	X	X	i	i
	Dietary[4]	●	●	●	●	●	●	●	●	●	●	●	●	i	i	X	●	i	X	i	●	●	●	●	●
Willamette River Sediment (< MHW)	Ingestion	X	X	X	X	i	●	●	●	●	○	○	○	○	X	○	i	○	X	i	i	i	○	●	○
	Dermal contact or root uptake	X	i	●	●	i	●	●	●	●	●	●	i	i	i	i	i	i	○	○	X	X	i	●	○
	Dietary[4]	X	X	X	X	●	●	●	●	●	●	●	●	i	●	X	●	i	X	●	●	●	●	●	●

Primary Source → Primary Release Mechanism → Secondary Source → Secondary Release Mechanism → Tertiary Source → Tertiary Release Mechanism → Exposure Medium → Exposure Route

Primary Sources:
- Atmospheric deposition
- Upland discharges, spills and leaks
- Industrial and POTW discharges
- Stormwater discharge and runoff
- Leaching from surfaces
- In-water discharges, spills and leaks
- Upriver sources

Release mechanisms / secondary sources:
- On-site surface soil
- Particulate and volatile emissions or deposition
- Discharge, spills/leaks of chemicals onto soil
- On-site subsurface soil
- Discharge, spills/leaks of chemicals into Willamette River
- Dust generation and volatilization
- Overland runoff
- Leaching, percolation and infiltration
- Groundwater
- Laminar flow and dispersion
- Slope erosion
- Resuspension, desorption, scouring
- Sedimentation, sorption
- Particulate and volatile emissions
- Discharge to surface water

Legend
- ● = Complete and significant pathway
- ○ = Complete and significance unknown
- i = Complete and insignificant pathway
- x = Incomplete pathway
- MHW = mean high water
- OHW = ordinary high water

Complete and Significant

The following criteria should be met before the pathway of a contaminant should be considered complete and significant:

• The pathway is theoretically or potentially complete; pathway can be supported by the scientific literature.
• Both the receptor and the exposure media are known, based on site-specific information, or can reasonably be assumed to co-occur in Portland Harbor.
• The pathway has been shown to be a primary route of exposure for any life stage of a receptor or surrogate organism based on laboratory, field, or site-specific data, and contaminant concentrations can reach effect levels solely by the proposed route or pathway under evaluation.

For example, exposure of fish to dissolved metals via uptake through the gill, and exposure of fish-eating birds to PCBs by consuming contaminated prey.

Pathways that are complete and significant will be assessed quantitatively. For example, the concentration of metals measured in the water column will be compared to concentrations shown to cause adverse effects to fish (in the scientific literature) to calculate a hazard quotient. If information needed to calculate a hazard quotient is not available, the preference will be to collect the needed information. If the information cannot be collected, a conservative value will be used in the hazard quotient calculation.

Complete and Significance Unknown

A pathway should be classified as complete and significance unknown if it meets the following criteria:

• The pathway is theoretically or potentially complete; pathway can be supported by the scientific literature.
• Both the receptor and the exposure media are assumed to co-occur in the Portland Harbor, but it is unknown whether or not the receptor uses the area sufficiently enough to be exposed to contaminants at effect levels.
• The pathway has been shown to be a primary route of exposure for any life stage of a receptor or surrogate organism but no laboratory, field, or site-specific data are available indicting contaminant can reach effect levels.
• It is unknown if concentrations of a contaminant will likely contribute to effect levels when combined with other pathways or contaminants.

For example, it is unknown how sturgeon use Portland Harbor. While exposure to sediment is likely, data are not available to assess quantitatively the extent that this receptor and exposure media co-occur.

For pathways that are classified as complete and significance unknown, additional site-specific data will be required to determine if they can be reclassified as complete and significant or complete and insignificant.

Complete and Insignificant

A pathway should be classified as complete and insignificant if it meets the following criteria:

• The pathway is theoretically or potentially complete; pathway can be supported by the scientific literature.
• The pathway is known to be a primary route of exposure for any life stage of a receptor or surrogate organism. However, laboratory, field, or site-specific data indicate contaminants are unlikely to reach effect levels solely by the proposed route or pathway under evaluation, or, it can be reasonably assumed that data would demonstrate that exposure via the pathway is insignificant compared to other pathways.

For example, while theoretically freshwater fish ingest water when feeding they do not actively drink due to the osmotic conditions in which they exist. Therefore, exposure to surface water via ingestion would be minor relative to other pathways. Also, PCB uptake from the water column is probably a complete pathway for piscivorous birds, but compared to the uptake of PCBs in contaminated prey items, the exposure is not significant.

Pathways that are complete and insignificant will not be assessed unless additional data become available that changes the significance value. Studies will not be specifically designed to address the complete and insignificant pathway combination. A hazard quotient will be calculated if data are readily available, and some pathway/receptor combinations could be described in the uncertainty section.

Incomplete

A pathway should be classified as incomplete if it meets the following criteria:

• The pathway is theoretically and/or practically not possible or not likely to occur in the area evaluated.
• Both the receptor and the exposure media are known, based on site-specific data, or can reasonably be assumed not to co-occur in Portland Harbor or would not use the area to the extent where exposure would occur.
• The pathway is not a primary route of exposure for any life stage of a receptor or surrogate organism based on laboratory, field, or site-specific data.

For example, juvenile salmon would not be eating fish.

Pathways that are incomplete will not be assessed.

Footnotes

[1] Riparian Soil = The bank area between the Mean High Water Mark (MHWM) and the Ordinary High Water Mark (OHWM). In some places, this area may extend above the Ordinary High Water Mark.

[2] Seeps = Seeps is water discharging on the bank area above the MHWM. It inclues the in-point of small tributaries to the river, groundwater seeping up to the bank area, and small piped discharges running over the bank.

[3] Willamette River Surface Water includes fish bearing tributaries and the in-point of year-round, significant flow outfalls.

[4] Dietary = Dietary means any tissue that is consumed by the species of interest within the exposure medium, and it includes trophic transfer.

[5] Reptiles = There is likely limited use of the ISA by only a few reptiles (garter snake, painted turtle and pond turtle). We have no surrogate species for reptiles, but protecting sensitive life stages of amphibians and birds is considered protective of reptiles.

[6] Areas with significant sheen could be a "complete and significant" pathway.

[7] Fish exposure to discharging Transition Zone Water will be assessed by focused surface water sampling.

[8] This is a "complete and significant" pathway for terrestrial invertebrates.

[9] This could be a "complete and significant" pathway for the terrestrial riparian area.

[10] These receptors will be assessed as potential pathways for contaminant movement through the food web. They will not be assessed as endpoints themselves.

Definitions

A **Complete** pathway means there is a potential for a contaminant to reach a receptor via the proposed route.
An **Incomplete** pathway means there is no potential for a contaminant to reach a receptor via the proposed route.

Definitions for Pathway Designation
Portland Harbor NRDA

DEFINITIONS

Complete
A complete pathway means there is a potential for a contaminant to reach a receptor via the proposed route.

Incomplete
An incomplete pathway means there is no potential for a contaminant to reach a receptor via the proposed route.

Significant
A significant pathway means there is a high likelihood that a contaminant can reach effect levels via the proposed route.

Insignificant
An insignificant pathway means there is a low likelihood that a contaminant can reach effect levels via the proposed route.

Significance Unknown
Significance unknown means that it is unknown that a contaminant could reach an effect level via the proposed route alone. However, the contaminant might contribute to effect levels when combined with other pathways or other contaminants.

CONDITIONS FOR PATHWAY AND SIGNIFICANCE COMBINATIONS

Complete and Significant

The following criteria should be met before the pathway of a contaminant should be considered complete and significant:

• The pathway is theoretically or potentially complete; pathway can be supported by the scientific literature .
• Both the receptor and the exposure media are known, based on site-specific information, or can reasonably be assumed to co-occur in Portland Harbor.
• The pathway has been shown to be a primary route of exposure for any life stage of a receptor or surrogate organism based on laboratory, field, or site-specific data, and contaminant concentrations can reach effect levels solely by the proposed route or pathway under evaluation.

For example, exposure of fish to dissolved metals via uptake through the gill, and exposure of fish-eating birds to PCBs by consuming contaminated prey.

Pathways that are complete and significant will be assessed quantitatively. For example, the concentration of metals measured in the water column will be compared to concentrations shown to cause adverse effects to fish (in the scientific literature) to calculate a hazard quotient. If information needed to calculate a hazard quotient is not available, the preference will be to collect the needed information. If the information cannot be collected, a conservative value will be used in the hazard quotient calculation.

Complete and significance unknown

A pathway should be classified as complete and significance unknown if it meets the following criteria:

• The pathway is theoretically or potentially complete; pathway can be supported by the scientific literature.

Medium	Exposure Route	Organization	Plants				Aquatic Invertebrates					Fish							Amphibians/Reptiles	Birds				Mammals
			Terrestrial Plants	Phytoplankton	Periphyton	Aquatic Plants	Zooplankton	Infauna	Epifauna	Shellfish	Crayfish	Largescale Sucker, Carp, Sturgeon (Omnivore/Herbivore)	Sculpin (Carnivore)	Peamouth (Carnivore)	Juvenile Chinook Salmon (Piscivore)	Smallmouth Bass (Piscivore)	Northern Pikeminnow (Piscivore)	Pacific Lamprey Ammocoete (Detritivore)	Frogs, Salamanders (Amphibians)	Osprey (Piscivorous)	Bald Eagle (Piscivorous)	Hooded Merganser (Diving Carnivore)	Spotted Sandpiper (Sediment probing invertivore)	Mink (Carnivore)
Air	Inhalation	EPA																						
		NOAA	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		FWS	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		DEQ	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	i	i	i	i	i	i
		Tribes	o	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	o	o	o	o	o	o
		All	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	i	i	i	i	i	i
Seeps	Ingestion	EPA																						
		NOAA	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	i	x	x	i	x	i
		FWS	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	i	x	x	i	i	i
		DEQ	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	i	x	x	o	•	i
		Tribes	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	o	i	i	i	o	o
		All	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	i	x	x	x	•	i
	Dermal contact/Root Uptake	EPA																						
		NOAA	o	x	x	x	•	x	•	x	x	•	x	•	i	x	x	x	o	i	i	i	•	•
		FWS	i	•	•	•	•	•	•	•	•	•	•	i	i	•	o	i	•	•	i	i	•	•
		DEQ	x	i	•	•	i	•	•	o	o	o	o	o	o	o	o	o	o	x	x	i	i	o	o
		Tribes	•	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	o	i	i	i	o	o
		All	i	x	•	•	x	•	•	x	x	x	x	x	x	x	x	x	•	x	x	x	i	•
	Dietary	EPA																						
		NOAA	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	•	o	o	o	o	•
		FWS	x	x	x	x	o	•	•	o	o	•	o	i	i	o	i	•	•	•	•	•	•	•
		DEQ	x	x	x	x	i	•	•	•	•	o	o	o	o	o	o	o	o	o	o	o	o	o
		Tribes	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	•	x	x	x	x	x
		All	x	x	x	x	x	o	o	x	x	x	x	x	x	x	x	x	•	x	x	x	•	i
Willamette River Surface Water	Ingestion	EPA																						
		NOAA	x	x	x	x	x	x	x	x	x	i	i	i	i	i	i	i	i	i	i	i	i	i
		FWS	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	i	i	i	i	i	i
		DEQ	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	i	i	i	i	i	i
		Tribes	x	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	o	o	o	•	•	o
		All	i	x	x	x	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i
	Dermal contact	EPA																						
		NOAA	x	o	o	o	•	o	•	•	•	•	•	•	•	•	•	•	•	i	i	i	i	i
		FWS	i	•	•	x	•	•	•	•	•	•	•	•	•	•	•	•	•	i	i	i	i	i
		DEQ	i	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	i	i	i	i	i
		Tribes	x	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	o	o	o	o	o
		All	i	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	x	•	i	i	i	i
	Dietary	EPA																						
		NOAA	x	x	x	x	•	o	•	o	o	i	o	o	•	i	i	o	o	o	o	o	o	o
		FWS	x	x	x	x	o	o	o	o	o	•	•	•	•	•	•	•	•	•	•	•	•	•
		DEQ	x	x	x	x	o	o	o	o	o	•	•	•	•	•	•	•	o	•	•	•	•	•
		Tribes	x	x	x	x	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
		All	x	x	x	x	o	i	•	•	o	•	•	•	•	•	•	•	•	•	•	•	•	•
Transition Zone Water	Ingestion	EPA																						
		NOAA	x	x	x	x	x	o	x	x	x	i	i	i	i	i	i	i	x	x	x	x	x	x
		FWS	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	i	x	x	i	i	i
		DEQ	x	x	x	x	x	•	•	x	x	x	x	x	x	x	x	•	x	x	x	x	x	x
		Tribes	x	x	o	•	x	•	•	o	o	o	o	x	x	x	x	•	x	x	x	x	i	x
		All	x	x	x	x	x	i	i	i	i	i	i	x	x	x	x	x	i	x	x	x	i	x
	Dermal contact or root up	EPA																						
		NOAA	o	x	x	o	i	o	i	o	o	x	o	x	x	x	o	o	x	x	x	x	x	x
		FWS	x	•	•	•	•	•	•	•	•	o	•	i	i	i	i	•	•	x	x	i	i	i
		DEQ	x	•	•	•	i	•	•	•	•	o	•	i	i	i	i	•	•	x	x	i	i	i
		Tribes	x	•	o	•	•	•	•	•	o	o	o	x	x	x	x	•	x	x	x	x	x	x
		All	x	x	•	•	i	•	•	•	•	o	o	x	x	x	x	•	x	x	x	i	i	x
	Dietary	EPA																						
		NOAA	x	x	x	x	i	o	o	o	o	o	o	i	i	i	i	o	•	o	o	o	o	o
		FWS	x	x	x	x	o	o	o	o	o	•	•	o	o	•	o	•	•	•	•	•	•	•
		DEQ	x	x	x	x	i	o	o	o	o	•	•	o	o	•	o	•	o	•	•	•	•	•
		Tribes	x	x	x	x	o	o	o	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
		All	x	x	x	x	i	•	•	•	•	•	•	i	i	•	i	•	•	•	•	•	•	•
Riparian (Between MHW and OHW)	Ingestion	EPA																						
		NOAA	x	x	x	x	x	x	x	x	x	i	i	i	i	i	i	i	x	i	i	i	i	i
		FWS																						
		DEQ																						
		Tribes																						
		All	x	x	x	x	i	x	i	x	i	i	o	i	i	i	i	i	i	i	i	x	•	o
	Dermal Contact/Root Uptake	EPA																						
		NOAA	•	x	x	x	x	x	x	x	i	i	i	i	i	i	i	i						
		FWS																						
		DEQ																						
		Tribes																						
		All	•	x	x	x	i	x	i	x	o	i	•	i	i	i	i	o	x	i	i	i	i	i
	Dietary	EPA																						
		NOAA	x	x	x	x	x	x	x	x	i	i	i	i	i	i	i							
		FWS																						
		DEQ																						
		Tribes																						
		All	x	x	x	x	x	x	x	x	o	o	i	i	i	i	i	i	•	i	i	x	•	o